

**AMENDMENTS TO THE CLAIMS**

Please amend claims 1, 24, 37, 49-50, 52-53, 55, cancel claims 17, 34, 54, and 62, and add claims 63-71 as set forth in the listing of claims that follows.

1. **(Currently amended)** A NO<sub>x</sub> abatement system comprising:

a NO<sub>x</sub> adsorber disposed in-line, downstream of, and in fluid communication with an engine; ~~and~~

a selective catalytic reduction (SCR) catalyst adapted for storing ammonia disposed in-line, directly downstream of, and in direct fluid communication with said NO<sub>x</sub> adsorber;

an off-line reactor including an ammonia forming catalyst being disposed upstream of, and in downstream fluid communication with the SCR catalyst; and

an off-line burner being disposed upstream of, and in downstream fluid communication with the off-line reactor and disposed upstream of, and in downstream fluid communication with an off-line reformer, and the off-line reformer being disposed upstream of, and in fluid downstream communication with the off-line reactor.

2-23. **(Canceled)**

24. **(Currently amended)** A method of NO<sub>x</sub> abatement, comprising:

storing engine ~~NO<sub>x</sub>~~ NO<sub>x</sub> from an exhaust stream in a NO<sub>x</sub> adsorber during a storage phase;

forming reformat including primarily hydrogen and carbon monoxide in an off-line reformer during a regeneration phase;

reacting the reformat with the stored NO<sub>x</sub> to produce ammonia during the regeneration phase; and

storing the ammonia in a selective catalytic reduction (SCR) catalyst during the regeneration phase, said SCR catalyst being disposed in-line, directly downstream of, and in direct fluid communication with said NO<sub>x</sub> adsorber, and an off-line reactor disposed upstream of, and in fluid communication with said SCR catalyst and an off-line burner and an off-line reformer being disposed upstream of, and in fluid communication with said reactor, said burner having an output received by said reformer and an output received by said reactor.

25-36. **(Canceled)**

37. **(Currently amended)** A method of NO<sub>x</sub> abatement comprising:

burning fuel off-line to form burner ~~NO<sub>x</sub>~~ NO<sub>x</sub>, wherein an off-line burner generates an output is upstream of and in received by an off-line fluid communication with a reformer and generates an output received by an off-line [[a]] reactor;

forming a reformat that includes primarily hydrogen and carbon monoxide in the reformer, off-line;

reacting the burner NO<sub>x</sub> with the reformat in the reactor to form ammonia, off-line;

storing the ammonia in an in-line selective catalytic reduction (SCR) catalyst;

introducing engine NO<sub>x</sub> to the SCR catalyst; and

reacting the engine NO<sub>x</sub> with the ammonia.

38-48. **(Canceled)**

49. **(Currently amended)** The system according to claim 1, further including, an off-line reformer adapted to produce a reformat having primarily hydrogen and carbon monoxide and disposed in selective fluid communication with, and upstream from said NO<sub>x</sub> adsorber and said SCR catalyst, and an output of the reformer being disposed for in-line fluid communication intermediate the engine and an in-line oxidation catalyst and for in-line fluid communication intermediate said in-line oxidation catalyst and an in-line particulate filter and for in-line fluid communication intermediate said in-line particulate filter and said NO<sub>x</sub> adsorber.

50. **(Currently amended)** The system according to claim 1, further including, a particulate filter disposed in-line, directly upstream of, and in direct fluid communication with said NO<sub>x</sub> adsorber; and an ~~a first~~ oxidation catalyst disposed in-line, directly upstream of, and in direct fluid communication with said particulate filter.

51. **(Original)** The system according to claim 50, wherein said particulate filter includes a gas permeable ceramic material having a honeycomb structure.

52. **(Currently amended)** The system according to claim 1, further including, an ~~a second~~ oxidation catalyst disposed in-line, downstream of, and in direct fluid communication with said SCR catalyst.

53. **(Currently amended)** The system according to claim 52, wherein said ~~second~~ oxidation catalyst includes zeolite.

54. **(Canceled)**

55. **(Currently amended)** The system according to claim 1, wherein the NO<sub>x</sub> adsorber includes a plurality of NO<sub>x</sub> adsorbers being disposed in a parallel arrangement to an exhaust flow direction through said SCR catalyst, said plurality of NO<sub>x</sub> adsorbers being disposed in-line, directly upstream of, and in direct fluid communication with said SCR catalyst.

56. **(Original)** The system according to claim 1, wherein the NO<sub>x</sub> adsorber includes a first and a second NO<sub>x</sub> adsorber, said first and said second NO<sub>x</sub> adsorber being disposed inline and directly upstream from the SCR catalyst such that said first and said second NO<sub>x</sub> adsorber are in direct fluid communication with the SCR catalyst, said second NO<sub>x</sub> adsorber being disposed downstream of a by-pass valve such that when the exhaust stream is diverted around the first NO<sub>x</sub> adsorber the exhaust stream passes through the second NO<sub>x</sub> adsorber prior to entering the SCR catalyst.

57. **(Original)** The system according to claim 1, wherein said NO<sub>x</sub> adsorber includes a plurality of NO<sub>x</sub> adsorbers and said SCR catalyst includes a plurality of SCR catalysts, and the plurality of SCR catalysts are disposed in-line and directly downstream of said plurality of NO<sub>x</sub> adsorbers, said plurality of SCR catalysts being in direct fluid communication with said plurality of NO<sub>x</sub> adsorbers, said plurality of SCR catalysts being adapted for storing ammonia.

58. **(Original)** The method according to claim 24, wherein the step of reacting the reformat further includes,

reacting the reformat with the stored NO<sub>x</sub> to produce greater than or equal to about 5,000 parts per million ammonia during the regeneration phase.

59. **(Original)** The method according to claim 24, further including,  
storing NO<sub>x</sub> in a by-passed exhaust stream in a by-pass NO<sub>x</sub> adsorber during the regeneration phase, and reacting the stored by-pass NO<sub>x</sub> with the reformat during a storage phase of said NO<sub>x</sub> adsorber, wherein the by-pass NO<sub>x</sub> is disposed in-line, directly upstream of, and in direct fluid communication with said SCR catalyst.

60. **(Original)** The method according to claim 24, wherein the NO<sub>x</sub> adsorber includes a plurality of NO<sub>x</sub> adsorbers being disposed in a parallel arrangement to an exhaust flow direction through the SCR catalyst, said plurality of NO<sub>x</sub> adsorbers being disposed in-line and directly upstream of, and in direct fluid communication with said SCR catalyst.

61. **(Original)** The method according to claim 24, wherein said NO<sub>x</sub> adsorber includes a plurality of NO<sub>x</sub> adsorbers and said SCR catalyst includes a plurality of SCR catalysts adapted for storing ammonia, and the plurality of SCR catalysts are disposed in-line and directly downstream from said plurality of NO<sub>x</sub> adsorbers, said plurality of SCR catalysts being in direct fluid communication with said plurality of NO<sub>x</sub> adsorbers.

62. **(Canceled)**

63. **(New)** A NO<sub>x</sub> abatement system comprising:

- a selective catalytic reduction (SCR) catalyst adapted for storing ammonia having serial fluid communication with a heat engine, said fluid communication occurring within an in-line exhaust flow path having an exhaust flow direction from the engine towards and through the SCR catalyst;

- a reactor including an ammonia forming catalyst, said reactor having an output in fluid communication with said exhaust flow path intermediate said engine and said SCR catalyst;

- a reformer having an output carrying reformat that fluidly communicates with said reactor, said reformat including primarily hydrogen and carbon monoxide; and

- a burner having a first and a second output, said first output being in direct fluid communication with said reactor and said second output being in direct fluid communication with said reformer.

64. **(New)** The system according to claim 63, further including,

- a mixing chamber intermediate the reactor and the reformer and intermediate the reactor and the burner, said mixing chamber receiving said first output of the burner and said output of the reformer.

65. (New) A NO<sub>x</sub> abatement system comprising:

- a heat engine including an in-line series exhaust conduit;
- a selective catalytic reduction (SCR) catalyst being disposed downstream from said heat engine in said exhaust conduit, the exhaust conduit including a fluid exhaust flow having a flow direction defined from the heat engine towards, and through said SCR catalyst, said SCR catalyst adapted for storing ammonia;
- a NO<sub>x</sub> adsorber being disposed in said exhaust conduit upstream of, and in direct fluid communication with said SCR catalyst;
- a particulate filter being disposed in said exhaust conduit upstream of, and in direct fluid communication with said NO<sub>x</sub> adsorber;
- an oxidation catalyst being disposed in said exhaust conduit upstream of, and in direct fluid communication with said particulate filter, and said heat engine being in direct fluid communication with said oxidation catalyst.

66. (New) The system according to claim 65, wherein the system further includes,

- an off-line reformer having an output,
- said output being in direct fluid communication with said exhaust conduit intermediate said heat engine and said oxidation catalyst, and
- said output being in direct fluid communication with said exhaust conduit intermediate said oxidation catalyst and said particulate filter, and
- said output being in direct fluid communication with said exhaust conduit intermediate said particulate filter and said NO<sub>x</sub> adsorber.

67. (New) The system according to claim 66, wherein the system further includes,

- an oxidation catalyst being disposed in said exhaust conduit being downstream of, and in direct fluid communication with said SCR catalyst.

68. (New) The system according to claim 65, wherein the system further includes, an off-line reactor having an output in direct fluid communication with the exhaust conduit intermediate said  $\text{NO}_x$  catalyst and said SCR catalyst and in direct fluid communication with said exhaust conduit intermediate said particulate filter and said  $\text{NO}_x$  catalyst.

69. (New) The system according to claim 68, wherein the system further includes, a mixing chamber being disposed upstream of said off-line reactor having an output in direct fluid communication with said off-line reactor, and an off-line reformer having a first and a second output, said first output being in direct fluid communication with said mixing chamber and said second output being in direct fluid communication with said exhaust conduit.

70. (New) The system according to claim 65, wherein the system further includes, an off-line burner having a first and a second and a third output, and said first output is in fluid communication with an off-line reformer, and said second output is in direct fluid communication with a mixing chamber, and said third output is in direct fluid communication with said exhaust conduit intermediate said particulate filter and said  $\text{NO}_x$  adsorber.

71. (New) A NO<sub>x</sub> abatement system comprising:

a heat engine including an in-line series exhaust conduit;

a selective catalytic reduction (SCR) catalyst being disposed downstream from said heat engine in said exhaust conduit, the exhaust conduit including a fluid exhaust flow having a flow direction defined from the heat engine towards, and through said SCR catalyst, said SCR catalyst adapted for storing ammonia;

a first oxidation catalyst disposed in said exhaust conduit intermediate said engine and said SCR catalyst;

a particulate filter disposed in said exhaust conduit intermediate said first oxidation catalyst and said SCR catalyst;

an off-line reactor having an output in direct fluid communication with said exhaust conduit intermediate said particulate filter and said SCR catalyst;

a mixing chamber having an output in direct fluid communication with said off-line reactor;

an off-line reformer having an output in direct fluid communication with said mixing chamber and in direct fluid communication with said exhaust conduit intermediate said heat engine and said first oxidation catalyst and in direct fluid communication with said exhaust conduit intermediate said first oxidation catalyst and said particulate filter;

an off-line burner having a first and a second output, said first output being in downstream fluid communication with said reformer and said second output being direct fluid communication with said mixing chamber; and

a second oxidation catalyst disposed in said exhaust conduit downstream of, and in fluid communication with said SCR catalyst.